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8 Envisioning solutions

Expert deliberation on environmental futures

Vilja Varho and Katri Huutoniemi

1 Introduction

In the midst of various environmental, economic and social crises, a great need exists for estimating future changes and designing policy for sustainable development. Large-scale sustainability problems, such as climate change, are complex in at least two levels. First, 'ontological complexity' (see Emmeche 2004) refers to the way climate change, for example, results from a complex set of interactions within a socio-ecological system, composed of subsystems and internal variables and connected to various other socio-ecological systems (see Ostrom 2009). Climate change research is complicated even if, in practice, it cannot encompass the dynamics of the whole socio-ecological system but operates from a particular frame of reference and usually on a smaller scale in terms of time, location, or theme. In the search for solutions, *interdisciplinarity* is called for. No single framework of knowledge could address the complex dynamics of climate change, including the ecological, economic, social, cultural and technological processes in which it is embedded.

The second source of complexity is problem framing. By this we refer to the view that sustainability problems often cannot be defined exactly. Instead, there are many definitions, and each definition seems to carry a presupposition of a solution. This type of problem has been called a 'wicked' problem (Rittel and Webber 1973). All problem definitions – as well as the proposed solutions – are based on some values, interests and theoretical assumptions. This complexity suggests that a multifaceted approach and deliberation of alternative views is needed. As it is unlikely that there will be a consensus about the best way to tackle a complex problem like climate change, at least not in the available time frame, gathering, comparing and combining various alternatives and viewpoints is crucial.

Another challenge to tackling complex sustainability problems is temporal. Just mapping the present situation in terms of the various sources and drivers of greenhouse gases, for example, is challenging. Uncertainties compound when we introduce the temporal dimension and consider the future possibilities of the system components. Many sustainability problems are deeply rooted in the society, and changing current institutions, such as the patterns of energy production and consumption, will take considerable time. Futures studies is a field that can provide methods and tools for tackling this temporal challenge.

In this chapter, we discuss an approach widely used in futures studies, expert deliberation, as a heuristic for envisioning solutions in the face of complexity. Expert knowledge is used in various methodological applications in futures studies and beyond. Often the goal has been to find a consensus, for example, in medical practices (e.g. Beers et al 1991; Fick et al. 2003), or to forecast future development by using Delphi surveys or expert committees (Aichholzer 2009). However, it is also used to create broader visions on possible solutions (Amara 1981). In these applications, the aim of expert deliberation is neither consensus nor accurate prediction of the future, but to find alternatives, consider possibilities, evaluate drivers and their interlinkages, as well as inspire discussion. It is in this latter sense that expert deliberation may be helpful in tackling wicked problems. Envisioning solutions is the first step of acting and reaching for solutions and therefore making the future.

The idea we develop in this chapter is that experts have, due to their prior learning and experience, a great deal of knowledge and heuristic skills that can provide sustainability analysts with a shortcut to future insight: Instead of trying to analyze a number of factors and trends by using a complicated theoretical apparatus, a researcher can tap into individual experts' ability to process complex information partly through intuition. In this framing, experts are treated not primarily as authorities but as technically competent and influential actors (Collins and Evans 2007), whose views shape our undertakings and ultimately, possibilities, in the face of sustainability challenges.

In what follows, we review how expert deliberation is used in futures studies, and in what ways it can be helpful in finding solutions to complex problems. We then discuss expert deliberation as a heuristic process by drawing on the literature on expertise as well as our own study of the future of transport emissions. To make the most of experts' heuristic capabilities, it is import to consider how expertise is defined, how expert panels are constructed, how their deliberation is managed, and what prospects for sustainable solutions the process yields. We illustrate these choices through a study where we used expert deliberation to search for alternative, well-founded futures of transport and its CO_2 emissions in Finland up to the year 2050. We call our Delphi-based scenario application *Q_2 scenarios*, which is a mixed method combining qualitative and quantitative techniques in expert deliberation (Varho and Tapio 2013). In conclusion, we suggest that expert deliberation is a useful heuristic for exploring and 'scoping' future solutions, on which there is, and probably will be, no scientific or political consensus.

2 Expert deliberation in futures studies

Expert deliberation is employed in various fields, but it has firm roots in the domain of futures studies. There cannot be factual knowledge about the future of a society, because the future does not yet exist, and societal development is not pre-determined even if it strongly depends on choices made today (de Jouvenel 1967). Just as the present or the past cannot be exactly known, the future is not entirely unknown or indeterminate, albeit the uncertainty is naturally greater. While we may consider it very probable that, for example, air travel will stay popular in the coming decades, we cannot be certain of the actual volume. In addition, surprises occur, such as the volcanic eruption in Iceland that stopped much of the air travel in Europe for several days in 2010. Visions and predictions of the future can also influence people's behaviour and either strengthen or weaken current tendencies, and thereby confirm or falsify the prediction (de Jouvenel 1967).

Thus, the purpose of futures studies is not so much to predict the future as it is to open new possibilities, consider changes, trends and phenomena also on longer time scales, and find ways to navigate future decisions to a desirable direction. Futures studies is organized around the assumption that the issues it covers are contingent upon an infinite number of interrelated factors, lack 'objective' properties, and will not be resolved by scientific inquiry. All of this is significant for sustainability studies as well. Futures studies methods are targeted more at discovering sound ideas and alternative paths than justifying them (Kuusi 1999), and thus offer tools for looking for solutions to various sustainability problems. Discussing possible futures is important, as views about the future affect the decisions made today.

Often a distinction is made between possible, probable and preferable futures (Amara 1981). Experts were traditionally asked to estimate what would be the most probable development. It is not necessarily business-as-usual, as respondents could expect there to be considerable policy changes in the future. However, experts can also be asked what they consider a preferable future, that is, the best possible future the respondent can expect. This distinction between preferable and probable futures increases markedly the variation of views, and helps to identify obstacles to the realization of the preferable future.

Expert deliberation outlines several possible paths, some of which are more sustainable than others. But sustainability is not something that can be conclusively defined (see Frodeman, Chapter 11, this volume). Instead, some emphasize certain aspects of it more than others. For example, it would be possible to slow down climate change with very drastic measures, such as banning private cars, but these might not be considered economically or socially sustainable. By searching for views among the experts we can visualize and bring to the scientific and public discussion alternative visions and paths. In spite of the pluralistic view of the future, the discussion is ideally rational in terms of both facts and values.

Various forms of expert deliberation in futures studies provide heuristic schemes for approaching complex sustainability issues. Whereas consensus-seeking methods are looking for one solution, scenario methods aim at widening the range of options and enabling several alternative solutions. Scenarios are alternative paths into the future and can be used, for instance, to inspire

Table 8.1 Examples of futures studies methods processing individual, team and panel expertise.

	One expert	*Interdisciplinary team*	*Transdisciplinary panel*
Single future (forecast)	*Genius forecasting*	*'Business as usual' modelling*	*Traditional Delphi*
Alternative futures (scenarios)	*Desktop scenarios*	*'What…if' modelling*	*Dissensus-based Delphi*

discussion or to support decision-making. There are, for example, individual futurists' heuristic scenarios. Experts also participate in interdisciplinary teams, for example, in 'what-if' modelling, and in transdisciplinary panels, as in Delphi studies (Table 8.1).

Material for scenarios can be obtained from experts through various means, such as scenario workshops, interviews, or the Delphi method. They each have their pros and cons. Workshops, for example, allow the experts to directly interact with one another. The Delphi method, on the other hand, has the benefit of preserving the anonymity of the experts. It means that the arguments of the panellists are visible to everyone, but the identity of the arguer is not. This is thought to encourage less conservative views, and to decrease problems associated with group dynamics, such as the tendency to stick to one's first stand, or to conform to answers from dominating persons (e.g. Dalkey and Helmer 1963). As we will discuss later, expertise is partly a social status granted by others, and the anonymous treatment of participants removes some of this from play. Even if experts are selected for the panel largely based on their socially defined status, their arguments are treated separately from it.

The Delphi method is an iterative process, which allows for deliberation and for the experts to learn from one another. The Delphi method was developed in the 1950s but has since experienced much variation. According to Rowe and Wright (1999), its basic characteristics include anonymity, iteration and controlled feedback, and these are likely to exist in all Delphi applications. Rowe and Wright (1999) also mention statistical aggregation of responses into a group response as a central characteristic, and originally the Delphi method did have the object 'to obtain the most reliable consensus of opinion of a group of experts' (Dalkey and Helmer 1963: 458). The hope was that an expert group could provide a reasonably probable picture of the future, although it was acknowledged that 'it cannot even ideally be expected that the final responses will coincide, since the uncertainties of the future call for intuitive probability estimates on the part of each respondent' (Dalkey and Helmer 1963: 459).

These types of applications still exist, for example, in technological forecasting (see Aichholzer 2009), but many dissensus-based Delphi variants (Steinert

2009) have increasingly rejected the idea of estimating probability and aimed at finding diversity or assessing preferability (e.g., Kuusi 1999; Tapio 2003; Varho and Tapio 2005, 2013). It is assumed that experts gather around certain arguments and therefore a number of crystallized views rather than consensus will be the outcome of the process (Rikkonen and Tapio 2009). The 'intuitive estimates' are no longer only about probabilities, as the preferred development is also taken into account, but the pursuit of intuitive, experience-based vision remains the heuristic behind the very idea of using experts in Delphi panels.

The variety of views that emerge from a panel can be encouraged by using suitable methods. Rafael Popper's (2008) Foresight Diamond aggregates dozens of methods that are used in futures studies and categorizes them according to two dimensions: creativity vs. evidence and (individual) expertise vs. interaction. The Diamond illustrates that not all desired properties can be maximized at the same time. Choosing approaches that encourage creativity, for example, may discourage experts from strictly evidence-based reasoning. The Delphi method is situated in the middle of the Foresight Diamond (almost equidistant from 'evidence' and 'creativity'), but Popper notes that it is increasingly used to explore normative possibilities. Imagining the preferable future clearly requires more creativity than estimating the most likely development.

Quantitative estimates about the future can also be obtained through mathematical models. The benefit in using expert deliberation is that it enables access to the reasoning and heuristic capabilities of several individual experts, instead of relying on a theoretical apparatus that follows a single, predetermined logic for calculating the impacts of a given set of drivers on a future state. Evolutionary psychologists (see Gigerenzer 2008) have even emphasized that sometimes fast and frugal heuristics can beat other information processing methods, especially when optimization through computational methods is impossible or there is great uncertainty involved.

3 Expert deliberation as a heuristic process

As implied above, expert deliberation is often used in tasks that cannot be successfully accomplished by any straightforward method. Long-term sustainability challenges definitely belong to this category, and various deliberative approaches are increasingly established in environmental social science (e.g. Hajer 1995; Dryzek 1997). Expert views may be sought for because they are believed to be both evidence-based and rational – they are thus taken as best estimates of an uncertain issue, including future events. Some other times, expert deliberation is implemented to support decision-making or to legitimize particular political choices. We suggest, however, that expert deliberation is valuable for reasons that are not widely discussed in the context of sustainability studies. In particular, in cases where the scope and number of potentially important factors are indeterminate, experts are worthy informants, or, perhaps more accurately, observers of information. In this section, we discuss expert deliberation as a heuristic process that can contribute to sustainability problem solving in a unique way. Particularly in the more technical parts of this section, we draw from our deliberative study on the future of transport.

3.1 Defining expertise

Expertise is both cognitively and socially determined. Expertise as a cognitive property refers to the acquired knowledge and skills possessed by an expert, whereas expertise as a social property refers to the possession of an expert status in the eyes of others. This distinction is important, because both meanings of the concept matter for sustainability problem solving, but for different reasons.

From a *cognitive* perspective, expertise is the possession of substantive knowledge of a domain of activity, including both propositional knowledge and tacit knowledge. It is a characteristic of both individuals and communities of practice, and it can be acquired through education, research, experience, occupation, or any other form of cognitive refinement. Acquiring cognitive expertise is usually a matter of socialization into the practices of a domain, but it is more than attribution by a social group. In this conception, individuals may or may not possess expertise independently of whether others think they possess it (Collins and Evans 2007: 3).

Even though the *social status* of an expert is often gained through demonstrated competence in a given area, the acquisition of expert status is a different social process than the acquisition of cognitive expertise. Typically it is formal degrees, higher professions and leading organizational positions that give a person the status of an expert in a particular domain, and thereby allow him or her to speak with authority (Saaristo 2000). While these properties are considered to indicate that the person has the relevant expertise, they do not guarantee it: the possession of expert status may have little to do with the possession of real and substantive expertise, and vice versa – a person without this status may possess similar skills to an authorized expert.

A central characteristic of cognitive expertise is the ability to make immediate, unreflective situational responses. According to the Dreyfuses' phenomenological analysis (Dreyfus and Dreyfus 2005), intuitive judgement is the hallmark of expertise: While 'deliberation' is certainly used by experts, it is done for the purpose of improving intuition, not replacing it. This is relevant here because in a targeted deliberation process experts are expected to manage complex information relatively quickly, in minutes or hours rather than weeks or years. They will need their own heuristics in order to deal with uncertainty and make connections between various drivers, for example. Such 'gut feeling' and intuition are gained through prior activities and experience, and are therefore affected by education and field-specific tacit knowledge.

These heuristic capabilities can help in complex and ambiguous situations where strict calculative rationality is not sufficient.

However, sustainability problem solving is not only about responding to problems similar to what one has encountered before, based on current knowledge. Instead, the experts need to consider various drivers and their relations in differing situations and to estimate long-term developments. Automation and experience are necessary but not sufficient elements in expert deliberation for future action. In envisioning, it is useful to be able to accept the unexpected, and sometimes even abandon conventional wisdom. Although these abilities can be learned through experience, they also require an open-minded attitude and willingness to depart from one's routine heuristics.

The definition and criteria for expertise, that is, the skills that matter in a domain of practice, are socially determined (Kaivo-oja et al. 1997; Turner 2001). The content of valid expertise is a contingent question that changes over time, varies across cultures, and – most importantly – depends on the problem at hand and how it is defined. In sustainability issues, it is often not certain just what kinds of expertise should be counted as relevant. The question is important because those whose expertise is held relevant for a problem gain power in defining and framing the problem.

From a future-oriented perspective, expertise is socially significant to the extent that it can *influence practice* (Bogner and Menz 2009). Referring to Beck's (1992) conception of risk society, Bogner and Menz (2009) note that what defines post-traditional experts is that they are, by virtue of their specific knowledge, politically influential:

> on the basis of specific knowledge that is derived from practice or experience and which relates to a clearly demarcated range of problems, [experts] have created a situation where it is possible for their interpretations to structure the concrete field of action in a way that is meaningful and guides action.
>
> (Bogner and Menz 2009: 54)

This definition illustrates that expert knowledge is a subtle form of power and thereby a vehicle for both maintaining and changing the existing patterns of thought and action. Expertise is thus important from the point of view of *acting* in the face of problems, rather than just describing or explaining them. This is not to say that expertise alone has the power to determine future development, but that experts are powerful stakeholders in defining what is real and possible in a society. Moreover, expert knowledge is not entirely transparent or accessible to outsiders, nor is there a way to hold experts accountable for the indirect power they exert when defining phenomena.

An important aspect of expertise is the entanglement of objective and subjective knowledge. Bogner and Menz (2009) consider expertise to consist of (1) *technical knowledge*, typically knowledge that can be achieved through education; (2) *process knowledge* which refers to the practices and modes of operation within a field, including, for example, interaction routines, organizational constellations and past events; and (3) *interpretative knowledge* which refers to the expert's subjective orientations, rules, viewpoints and interpretations. This last dimension of expertise is knowledge that springs from the person more clearly than the other two dimensions, and includes ideas, ideologies and 'fragmentary, inconsistent configurations of meaning and patterns of explanation' (Bogner and Menz 2009: 52). It implies that each expert not only represents a particular domain or community of knowledge, but is also an individual human being, a product of inherited characteristics and a unique life history; even exactly the same education and job trajectory could not create two identical experts.

Selinger and Crease (2002: 245) discuss subjectivity by emphasizing that expertise is built upon the person, and the 'prejudices, ideologies, hidden agendas, or other forms of cultural embeddedness that person might have' are not miraculously shed during the process of becoming an expert. Although such properties may have a negative connotation, it is through subjectivity that many positive aspects of expertise come about: ethical consideration, empathy, responsibility and many other valuable aspects of expert deliberation on future solutions derive from experts' ability to personally engage with sustainability problems.

In expert deliberation, all aspects of expertise contribute to the heuristic process. It is neither possible nor desirable to operate in a 'vacuum', as expert knowledge is assimilated into personal interpretations, and reflects the societal environment in which the expert operates. Not only the professional field or organizational position but also age, gender, nationality, or ethnicity can affect the content of expertise through shaping the conditions in which individuals acquire their cognitive skills. The embeddedness of expertise in context is visible also in the actions of deliberating experts themselves. Some are more strict in controlling what they say, and try to stick to 'facts' as they know them, others take on the role of a visionary more voluntarily and are comfortable also making openly value-based judgements, particularly as long as they are asked to distinguish between probable and preferable views.

In a project involving expert deliberation on future solutions to complex problems, it is crucial to consider carefully how expertise is defined. How closely do we want to stick to traditional approaches that often lean towards defining expertise through social status and tend to support the status quo of dominant types of expertise? In the face of complex challenges, increased demands for inter- and transdisciplinary approaches have emerged (Huutoniemi et al. 2010). In democratic societies, it is also considered important to give voice to wider groups of people. Widening the definition of expertise itself is called for, particularly with regard to understanding and solving problems that involve ecological, economic and social aspects (e.g. Beck 1994; Saaristo 2000). This means recognizing the expertise beyond the establishment, or 'counter-expertise' that challenges the status quo (Irwin and Wynne 1996;

Saaristo 2000). The increasing attention to the expertise of non-governmental organizations (NGOs) is illustrative of this tendency. At the same time, however, failing to make any distinction between experts and non-experts may lead to the development of a 'technological populism' under which 'real', cognitive expertise would deserve no special respect (Collins and Evans 2007: 8).

3.2 Assembling an expert panel

The quality of expert deliberation depends to a great extent on the composition of an expert panel. Panellists have to be selected on the basis of the research question: what is considered relevant expertise for the task. If the objectives are to find solutions through diversity of views and share information from various fields, it is important to be open to various kinds of expertise. In futures studies, there have long been calls for *plurality policy* (Kuusi 1999: 181) in the expert panel construction (Linstone and Turoff 1975; Vinnari 2008). This usually refers both to the diversity of knowledge domains, including, for example, technological, natural scientific and social scientific knowledge, and to the diversity of organizations, such as universities, public administration, business, or non-governmental organizations. Choosing experts according to plurality policy enables taking more problem framings and solutions into consideration. It is thus an essential first step in envisioning solutions.

From a heuristic viewpoint, expertise is valuable precisely because it is not 'neutral'. Established fields and organizations each have their own particular expertise, but also their own 'set of world-views and patterns of interpretation' (Bogner and Menz 2001: 2). Expertise thus always includes 'biases', in the sense that it rests on a particular way of interpreting the world and thereby loses sight of alternative interpretations. Importantly, experts can be quite ignorant of this blindness themselves. They may take certain axioms or approaches as given, without realizing that there are alternative views. This is why the diversity of expertise is particularly important when using expert deliberation. Given the aim of rational communication, experts are expected to critically consider their own views in the light of the arguments of others, and the more variety there is in a panel, the more the experts are encouraged to process new information (see Huutoniemi 2012).

Our application of Q_2 scenarios provides an elaborated strategy for assembling an expert panel by attempting to explicitly incorporate values, desires and other personal or contextual aspects of expertise into the deliberation process. The method is designed with a view to produce expert visions or scenarios that rest on a wider and deeper knowledge than laypeople's views would be, but without assuming that factual knowledge alone could provide solutions to 'wicked' problems that evade single definition. In addition to the diversity of expertise as established in plurality policy, two other issues stand out in identifying and assembling experts.

First, it seems useful to *extend the boundaries* of relevant expertise by including also other than formal types of expertise in a narrowly defined domain. Given the complexity of sustainability problems, the domains and types of potentially relevant expertise are numerous. What may appear irrelevant from a traditional perspective may turn out to be an important source of new insight. This does not mean abandoning the concept of expertise, but recognizing the various communities of practice that may have developed their own understanding of an issue. Here the most important criterion for 'expertise' is that a participant is a competent member of a network or activity (cf. Collins and Evans 2007; Collins 2013), which enables him or her to envisage aspects of future in a way that is both relevant for the issue at hand and goes beyond ubiquitous public knowledge. In this view, relevant expertise is seen to derive from particular stakeholder positions, not from outside or above them.

In our project focusing on the climate policy of transport, an overwhelming majority of the participants (ca. 80 per cent) were experts on the more traditional scales of education and work experience. However, some did not have the social status of an expert because, for example, they lacked formal education in transport issues. As an extreme case, we included a high school student who was interested in climate issues. An 18-year-old was expected to have knowledge of young citizens' everyday life and future expectations, including their transport habits and values. As we were looking approximately 40 years into the future, the views of today's youth were considered particularly important. Collins (2013) discusses three dimensions of expertise: 'esotericity', 'accomplishment' and 'exposure to tacit knowledge of a domain'. Although being a young Finnish citizen is hardly expertise according to the first two dimensions, it does fulfil the third dimension. Being immersed in a subculture gives a person the ability to see and interpret the world in ways that are not obvious to others.

Second, as discussed earlier, expertise also has a subjective dimension. Although individual experts will always have something new to bring to the panel, some personal properties matter more than others. In a future-oriented study, it is important to pay attention to the participants' *attitude to change*. Some people rely more on past experiences, trends and conventional wisdom, whereas others are more able to look out of the box, or are more sensitive to weak signals of change (Mendonça et al. 2004) in the society. This means that they are able to envision futures that are radically different from today, and help to open up visions and possibilities. Although these experts are needed to find new solutions, others may find their views unrealistic. They may also miss important knowledge that other experts have. If a vision lacks credibility, it easily becomes ignored by others and lacks influence. Variation of intellectual attitudes in a panel is helpful to encourage dialogue and learning between different stances.

An expertise matrix (introduced by Kuusi et al. 2006) is useful in ensuring variation within the panel. The desired categories of variation are named in the matrix, where each panellist is characterized. Any gaps are easily revealed and new experts may be invited (Varho and Tapio 2013). In our project focusing on the climate policy of transport, the variety of expertise was sought after by including experts from all transport modes, and from many different professional communities. There was also variation in education level, background organization (e.g. administration, politics, business and research), age and gender.

When focusing on the heuristic aspects of expert deliberation, however, an expert matrix has clear limits. It is often impossible to know in advance an expert's attitude to change, for example, and thereby to ensure variation in this aspect. Similarly, identifying relevant types of expertise or prioritizing between them is an ambiguous task when confronting complex sustainability problems. Almost any community may hold valuable knowledge or views.

3.3 Facilitating expert deliberation

Deliberation refers to communication between experts as well as to the experts' careful consideration. In a heuristic approach, it is done for the purpose of improving intuition, not replacing it. For this purpose, we have developed a Delphi-based technique we call 'Q_2 scenarios', where the 'Qs' refer to the combination of quantitative and qualitative methods in collecting expert views (Varho and Tapio 2013). It aims at a kind of deliberation that is compatible with the Habermasian ideal communication (Habermas 1981, 1982). The idea is that arguments count instead of arguers and that the discussants respect and learn from each other. Actually, all expert methods that include some sort of interaction include the opportunity to learn, and it may be an important motive to participate in the process (Aichholzer 2009). The connection between Delphi methods and Habermasian ideal communication has been mentioned, for example, by Kuusi (1999), Tapio (2003), Gould (2004) and Yetim (2009), but not explored in detail (Yetim and Turoff 2004). While the concept of ideal communication refers mainly to discourse ethics, it also provides a basis for enhancing experts' thinking and problem solving in societal contexts. In the following, we illustrate the facilitation of expert deliberation by using our experience of Q_2 scenarios as an example.

We posed wide-ranging questions that involved numerous possible variables and required a consideration of a large number of drivers. For example, we asked how the volumes of passenger transport in various modes would evolve over the next 40 years. The factors influencing the outcome relate to population growth and ageing, economic structure and volume, work culture, transport infrastructure, people's values, transport policy choices, and so on; the experts were expected to use their knowledge, experience and intuition to come up with quantitative estimates. The estimates were approximate, but numerical responses produced data that could easily be compared and understood by other experts (Tapio et al. 2011).

The experts were asked to provide both a probable and a preferable future image. This approach does not only accept but fully embraces the subjectivity of experts. While this distinction is regularly made in futures studies to serve

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various purposes (see Section 2), we emphasize its heuristic functions: it helps the experts to recognize their own preferences and situate them among a broader set of interests and values.

After having filled the quantitative questionnaire, experts were asked to give reasons for their estimates and address a set of qualitative themes in personal interviews. Interviews also provided the experts with an opportunity to discuss topics that had not been asked about. Quantitative and qualitative responses provided input for the second, extended questionnaire. It showed the panellists' anonymous answers to the first questionnaire, and was accompanied by a compilation of qualitative arguments for the answers. Each panellist was asked to take a look at the responses before answering the second questionnaire. The second round offered each panellist the opportunity to learn from each other and on that basis, change his or her answer. Together with the interviews, the two-round Delphi process ensured that the scope of expert deliberation was not limited to the problem as initially defined by the researchers.

In comparison to a traditional Delphi process, the Q_2 scenario method allows for more individuality in deliberation, and for each expert to rely on their own modes of thinking and communicating their thoughts. For example, an expert panel may include participants who know the matter under study very well, but are unwilling or unable to offer quantitative estimates; interviews are a way to incorporate their expertise into the envisioning process. The combination of numerical, verbal and visual elements can also be helpful. For example, the questionnaire we used in our study was sent in MS Excel file format, displaying past trends as graphical representations. When a respondent gave his or her estimate about a future value, the programme immediately showed the answer in the graph. This type of feedback can help visually oriented experts to give estimates, even if they are not very comfortable with numbers.

While the Q_2 scenario method involves techniques that inspire experts' own reasoning, the depth of communication between experts was fairly limited in our case. There was no guarantee that the panellists actually considered the views of the other panellists, although the material was given to them. In general, if the range of expertise in a panel is wide, the argumentation of one expert does not necessarily meet that of the others, leaving the deliberation of issues thin (Huutoniemi 2012). More profound communication would be needed to overcome this challenge. For example, the deliberation process could be extended to include expert workshops where the results are discussed and elaborated on (see e.g. Rikkonen and Tapio 2009; Levänen and Hukkinen 2013). At this stage, however, the anonymity would have to be abandoned, and the issues stemming from group dynamics would complicate the process. For example, some respondents might feel threatened by the various types of expertise, reject them as inappropriate, or simply take them at face value (for trust and dialogue in social dynamics, see Paloniemi and Vainio, Chapter 9, this volume). On the other hand, opening the process to a face-to-face deliberation would enable the invitation of new participants and stakeholders into the discussion.

3.4 Looking for solutions

When expert deliberation is employed in exploring solutions, there must be an initial problem or problem situation for which the experts are to respond. With complex sustainability issues, defining the problem is obviously difficult, as there is a persistent ambiguity about the nature of the problem. It is thus important to leave each expert enough room for the redefinition of the problem. In our study, the large CO_2 emissions from transport were considered the initial problem. While this framing in itself set some boundaries to the problem under consideration, it allowed for multiple views on an appropriate target level of the emissions and for multiple strategies to reduce the emissions; these were left to the experts to define. The interviews, in particular, gave room for the experts to bring up other related problems, drivers and viewpoints.

In addition to flexibility in problem framing, insightful solutions were probed by asking experts to describe both a probable and a preferable future (Amara 1981). The probable future refers simply to the future image the panellist considers most likely. The preferable future, in turn, refers to the panellist's preferred future image among the many futures he or she considers possible in terms of technological, economic, political, social, ecological and other constrictions. This future image is personal and value-laden, as what one person considers preferable might not be at all preferable to another.

An example of the variety that can result from different starting points was the way in which different experts created their future images in the transport case. Most of the experts looked at the past trends and started from the present, considering mainly how people move today, and how they may wish to move in the future. They usually estimated that transport policies will change travel behaviour to more sustainable modes to some extent, while the emission targets will not be met. Even these views had great variety in terms of assumed emission reductions. Others started from the premise that CO_2 emissions have to be cut by a very large percentage, and that any policies necessary for such a change would be implemented. The resulting future images differed drastically. This variation may imply different assumptions on sustainability. Some experts emphasized the individual need or right for mobility as a part of economic or social sustainability (see also Banister, Chapter 4, this volume), whereas others emphasized environmental dimensions and preferred a future where emission targets are met, even if it meant radical changes to mobility patterns. The latter respondents seemed to transform the problem from 'how much and how to reduce the emissions from transport' to 'what would a low-emission transport system look like'.

Expert deliberation can make such differences visible without aiming for a single solution. Alternative future paths can be used to provoke discussion, to influence policy and practice, or to guide future research (see also Tapio et al., Chapter 5, this volume). Since our study included the goal to communicate the results to transport decision makers and the public, we organized the data into a set of different scenarios. For this purpose, the data was condensed through cluster analysis of the second round questionnaire responses (see e.g. Everitt et al. 2001) and through qualitative directed content analysis of the interviews (Hsieh and Shannon 2005). These produced alternative future states of various qualitative and quantitative variables. For example, we had numerical estimates about the volume of passenger car use in 2050, as well as qualitative estimates about the kind of cars that would become fashionable. The alternative future states of variables were used to create a number of different scenarios. Results were presented as written scenario descriptions as well as graphs depicting the numerical variables. Combining qualitative and quantitative information in reporting makes the scenarios more useful in decision-making and public discourse, because it allows for comparison between different scenarios and between the scenarios and other material, such as emission targets, without losing sight of the assumptions behind each scenario (see Varho and Tapio 2013).

In our study, the different expert views and the scenarios that were constructed from them were not always ‘solutions’ to the CO_2 problem. Even the preferable future images of many experts included relatively high emissions, because these experts considered it impossible to reach strict emission targets, although all participants shared the view that emissions must and can be cut. However, considering the drivers and possibilities of change is the first step in finding solutions. Further steps may include the integration of these scenarios with other, more strictly solution-oriented futures studies methods. For example, the heuristic future images produced in our study were used in a backcasting (see Robinson 1990) project where researchers selected and listed policy packages and calculated with mathematical modelling how the end states of the scenarios could be attained (Tuominen et al. 2012; Tuominen et al. forthcoming). In this way heuristic methods and calculative methods can complement each other.

4 Conclusions

Solutions to sustainability problems lie in the future, even if action needs to be taken now. The concepts and methods developed in futures studies can therefore be helpful. The Delphi method and other techniques for expert deliberation used to aim at finding the best solution, but are now also used for stimulating, searching and organizing ideas. This tendency is compatible with the current understanding of the complexity of societal problems. In the lack of common definition of problems or shared value frameworks in which to consider solutions, expert deliberation can be used to pin down alternative views. When we look into the future and consider things that by definition do not yet exist, we also need societal imagination and heuristics along with more conventional and objective knowledge.

This chapter has discussed expert deliberation as a heuristic process and addressed ways to engage experts' special capabilities in processing complex information in a purposeful manner. In particular, we have focused on expert insight as a vehicle for tackling sustainability problems that are embedded in highly complex socio-environmental systems and are difficult to solve or even to define conclusively. Expert deliberation can contribute to sustainability problem solving by considering possibilities, opening our minds to alternative visions, evaluating drivers of future development, observing and comparing alternatives, and inspiring broader discussion on possibilities and paths for a sustainable future. To make the most of the experts' competence on such tasks, we have stressed the importance of identifying relevant types of expertise, ensuring a variety of experts in a panel, and facilitating the deliberation process in an appropriate manner.

Knowledge, experience and heuristic capabilities intertwine. But so do expertise and power. Experts were defined in this chapter to be influential actors, whose views matter for at least two reasons. First, expert knowledge does not only reflect the world 'out there', but actively shapes the reality, or specific domains of it, and creates possibilities for action in these domains (see Law 2004). Second, sustainability problems may be rooted in the existing patterns of thought and practice which are partly maintained by expert systems. Systematic scrutiny and critical reflection on these patterns is important for envisioning sustainable solutions. This can be accomplished through an anonymous, iterative Delphi process where alternative patterns of thought are revealed and different experts are encouraged to learn from one another.

At the same time, expert deliberation involves heuristic elements that cannot be made transparent or fully accounted for. Plurality policy in choosing experts in a panel, as well as facilitation towards ideal communication, create conditions for critical self-reflection, but do not hold experts responsible for their insights. Embracing expert intuition is, however, crucial for effective problem solving, even though it may depart from both the calculative rationality of scientific inquiry, on the one hand, and from the ideal of transparency and accountability in political decision-making, on the other hand. Expert deliberation is not just a method for anticipating the future, but, most importantly, the first step in finding ways towards a better future. In this view, expert deliberation should maximize problem solving and pin down alternative visions, whereas political choices should be left to the whole society. In the future, more attention should be paid to how to bring the various views, scenarios and other yields of expert deliberation into public use in a fruitful way.

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